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(54) METHOD FOR CONTROLLING MOBILE PHONE TO BE MUTE THROUGH FLIP, AND MOBILE PHONE

(57) Disclosed are a method for controlling a mobile phone to be mute through flip, and a mobile phone. The method comprises the steps: when a mobile phone receives a call, detecting a situational pattern of the mobile phone; if the situational pattern is a ringing pattern, controlling a front-facing camera to acquire image data every preset time; and if the current image data is all-black image data and image data acquired in the previous time is not all-black image data, switching the situational pattern of the mobile phone into a mute pattern, and controlling the front-facing camera to stop acquiring image data. By means of the present invention, a user can conveniently and quickly switch a situational pattern of a mobile phone into a mute pattern by just flipping over the mobile phone.

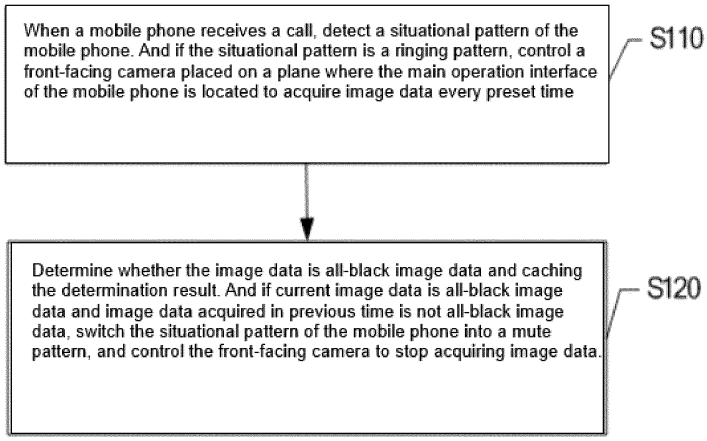

FIG. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of mobile terminals and, in particular, to a method for controlling a mobile phone to be mute through flip and to a mobile phone.

BACKGROUND OF THE INVENTION

[0002] With the development of mobile communication technologies, wireless communication devices are increasingly intelligentized. A smart phone having a function of being mute through flip is now available. The so-called being mute through flip is that a user can automatically switch the situational pattern of a mobile phone into the mute pattern by simply turning the front face of the mobile phone downwards when the mobile phone receives a call. With this function, the user does not have to reject an incoming call in some specific occasions, such as during a meeting or a class, where it is not appropriate to have the incoming ring tone or vibra alert on, and can quickly and conveniently switch the situational pattern of the mobile phone into the mute pattern with a simple flip action of the mobile phone.

[0003] However, the existing method for controlling the mobile phone to be mute through flip is generally to implement the mute control by using a gravity sensor, a direction sensor and the like to detect the flip action of the user. The essence of the method is to calculate whether the user makes the flip action of the mobile phone by acquiring the 3D acceleration value of the mobile phone. However, this method can easily cause erroneous judgment. For example, when the mobile phone is in a moving state together with the user, who for instance is riding on a vehicle such as a train, a car and the like, the 3D acceleration value of the mobile phone is affected by the external environment and an erroneous judgment is easily caused. Or, the mobile phone is placed on a supporting surface with certain degree of inclination, for example, the user is having an art class or an English video class, and the desk of the user has an inclination of more than 30 degrees. Because it is not placed horizontally, the mobile phone cannot recognize the flip action when the user flips the phone. Under such circumstances, although the user makes the flip action of the mobile phone, the effect of controlling the mobile phone to be mute cannot be achieved, which brings inconvenience to the user.

[0004] Therefore, the prior art still needs to be improved and developed.

SUMMARY OF THE INVENTION

[0005] A technical problem to be solved by the present invention is to provide a method for controlling a mobile phone to be mute through flip and a mobile phone regarding the defects of the prior art.

[0006] The technical solution adopted by the present invention to solve the technical problem is as follows:

The present invention provides a method for controlling a mobile phone to be mute through flip, which comprises the following steps of:

- when a mobile phone receives a call, detecting a situational pattern of the mobile phone;
- if the situational pattern is a ringing pattern, controlling a front-facing camera placed on a plane where the main operation interface of the mobile phone is located to acquire image data every preset time;
- transmitting the image data to a mobile phone base band chip; and
- using the mobile phone base band chip to determine whether the image data is all-black image data and caching storing the determination result; if the current image data is all-black and image data acquired in the previous time is not all-black image data, switching the situational pattern of the mobile phone into a mute pattern, and controlling the front-facing camera to stop acquiring image data.

The present invention further provides a method for controlling a mobile phone to be mute through flip, which comprises the following steps of:

- when a mobile phone receives a call, detecting a situational pattern of the mobile phone; if the situational pattern is a ringing pattern, controlling a front-facing camera placed on a plane where the main operation interface of the mobile phone is located to acquire image data every preset time; and
- determining whether the image data is all-black image data and caching storing the determination result; if the current image data is all-black and image data acquired in the previous time is not all-black image data, switching the situational pattern of the mobile phone into a mute pattern, and controlling the front-facing camera to stop acquiring image data.

The present invention further provides a mobile phone to be mute through flip, which comprises

- a base band chip,
- a front-facing camera and
- a ring output module,
- wherein the base band chip further comprises an image acquisition module, an all-black judgment module, a flip judgment module and a ring control module, wherein:
- the front-facing camera is placed on a plane

where the main operation interface of the mobile phone is located, used for acquiring image data every preset time when the mobile phone receives a call and the situational pattern of the mobile phone is a ringing pattern, and transmitting the image data to the image acquisition module;

- the image acquisition module is used for acquiring the image data transmitted by the front-facing camera when the mobile phone receives a call and the situational pattern of the mobile phone is a ringing pattern;
- the all-black judgment module is used for determining whether the image data acquired by the image acquisition module is all-black image data, and caching storing the determination result;
- the flip judgment module is used for sending a mute control message to the ring control module when the all-black judgment module determines that the current image data is all-black image data and the image data acquired in the previous time is not all-black image data, and triggering the base band chip to control the front-facing camera to stop acquiring the image data at the same time; and
- the ring control module is used for controlling the ring output module to output different modes of rings.

[0007] According to the method for controlling a mobile phone to be mute through flip and the mobile phone provided by the present invention, the mobile phone is added with a new function. That is, when the mobile phone receives a call, the mobile phone automatically detects the situational pattern. When the situational pattern is not a mute pattern, the image data is acquired in real time through the front-facing camera of the mobile phone, and the acquired image data is transmitted to the mobile phone base band chip. When determining that the acquired image data is all-black image data and the image data acquired in previous time is not all-black image data, the mobile phone is considered to flip for once, and the mobile phone automatically switches the situational pattern into the mute pattern. Through the technical solution of the present invention, the user can conveniently and quickly switch the situational pattern of the mobile phone into the mute pattern only through a simple flip action of the mobile phone and can make the phone mute without needing to reject the incoming call in some specific occasions which are not suitable for playing the incoming ring or vibra alert such as during a meeting, a class and the like. The mobile phone is particularly suitable for a situation when the mobile phone is under a moving state or located on an inclined plane. Moreover, the mobile phone has a simple structure and high control accuracy, and provides conveniences for the user.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

FIG.1 is a flow chart of a preferred embodiment of a method for controlling a mobile phone to be mute through flip according to the present invention.

FIG.2 is a flow chart of determining whether a frame of image data is all-black image data in the preferred embodiment of the method for controlling a mobile phone to be mute through flip according to the present invention.

FIG.3 is a flow chart of specially applying and implementing the method for controlling a mobile phone to be mute through flip according to the present invention.

FIG.4 is a structure block diagram of a preferred embodiment of a mobile phone to be mute through flip according to the present invention.

FIG.5 is a schematic diagram for connecting a front-facing camera and an image acquisition module of the preferred embodiment of the mobile phone to be mute through flip according to the present invention.

FIG.6 is a specific structure block diagram of an all-black judgment module of the preferred embodiment of the mobile phone to be mute through flip according to the present invention.

FIG.7 is a specific structure block diagram of a ring control module of the preferred embodiment of the mobile phone to be mute through flip according to the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0009] To make the objective, technical solution and advantages of the present invention more clear, the present invention is further described in detail with reference to the drawings and embodiments hereinafter. It should be understood that the specific embodiments described here are merely used for explaining the present invention, but are not intended to limit the present invention.

[0010] Embodiments of the present invention provide a mobile phone to be mute through flip, which may be used for performing the method for controlling a mobile phone to be mute through flip provided by the embodiments of the present invention. To be specific, in the embodiment, the mobile phone to be mute through flip comprises a memory and one or more than one program, wherein the one or more than one program is stored in

the memory, and is configured to perform the method for controlling a mobile phone to be mute through flip according to the embodiments of the present invention through one or more than one processor. Certainly, the method for controlling a mobile phone to be mute through flip according to the embodiments of the present invention may also be used for other electronic mobile terminals, which include but are not limited to smartphones, tablet computers, e-book readers and MP4s (Moving Picture Experts Group Audio Layer IV) player and the like.

[0011] FIG. 1 is a flow chart of a preferred embodiment of a method for controlling a mobile phone to be mute through flip according to the present invention. The method comprises the following steps.

[0012] Step S110: When a mobile phone receives a call, the mobile phone automatically detects a situational pattern of the mobile phone. When the situational pattern is not a mute pattern (such as a ringing pattern), image data is acquired through a front-facing camera placed on a plane where the main operation interface of the mobile phone is located, and the acquired image data is transmitted to a mobile phone base band chip. The plane where the main operation interface of the mobile phone is located is a flat plane, and the front-facing camera is placed on the plane. Preferably, the front-facing camera of the mobile phone acquires image data every preset time. The preset time may be 100ms, 50ms and the like. The value may be set and saved in a mobile phone system when delivery. For example, the front-facing camera of the mobile phone acquires the image data in every 50ms, and the image data acquired in every time may either be a frame of image data or multiple frames of image data.

[0013] Step S120: Determine whether the image data is all-black image data and caching the determination result. When determining that the currently acquired image data is all-black image data, check whether the cached image data acquired in the previous time is all-black image data. When the currently acquired image data is all-black image data and the image data acquired in the previous time is not all-black image data, the mobile phone is considered to flip for once, the situational pattern of the mobile phone is controlled to switch to the mute pattern, and the front-facing camera is controlled to stop continuously acquiring the image data.

[0014] Under a normal situation, the mobile phone is placed with the front side upwards. After flip of the mobile phone, the front side of the mobile phone is downwards and is in contact with such a supporting surface as a desktop and the like. At this time, the image data captured by the front-facing camera installed on the plane (namely the front side of the mobile phone) of the main operation interface of the mobile phone is certainly all-black image data. When the mobile phone is placed in a pocket or bag, although the image data acquired by the mobile phone is all-black image data, the ringing pattern of the mobile phone may not be automatically switched to the mute pattern at this moment because the image data acquired in the previous time is also all-black image data, and the mobile phone does not have an action of changing from a non-all-black environment to an all-black environment. Adopting the method according to the present invention to recognize whether the mobile phone has a flip action so as to control the mobile phoen to switch the situational pattern, which is not limited by the supporting surface for placing the mobile phone and the acceleration of the located environment; therefore, the control accuracy is very high. Meanwhile, by comparing the image data acquired twice, a situation that the user misses the incoming call due to the mute of the incoming call of the mobile phone when the user puts the mobile phone in the pocket or bag is also avoided.

[0015] In addition, in the embodiments of the present invention, when the mobile phone receives a call, the mobile phone base band chip monitors whether a hang-up signal exists in real time. When monitoring that the other side hangs up the call, the mobile phone is controlled to terminate ringing. Meanwhile, the front-facing camera is controlled to stop acquiring the image data. The step may be carried out independently, and is not influenced by the implementing step of mute control through flip.

[0016] Preferably, step S110 specifically comprises the steps as follows: when a mobile phone receives a call, the mobile phone automatically detects the situational pattern thereof; if the situational pattern is a ringing pattern, the front-facing camera of the mobile phone is controlled to acquire image data every preset time, wherein a frame of image data is acquired in every time. The front-facing camera is triggered by the frame synchronization signal to transmit the acquired image data of the current frame to the base band chip; moreover, the front-facing camera is triggered to transmit a frame of image data in each time when receiving a frame synchronization signal.

[0017] Further, one frame of images consists of a plurality of pixels, for example, one frame of images consists of CMAX pixels; therefore, the step of determining whether the image data is all-black image data comprises: determining whether all the pixels of the image data are black one by one, wherein in the embodiment, determining whether all the pixels of the image are black according to the format of the image data transmitted between the base band chip and the front-facing camera comprises two situations as follows.

[0018] Situation I: When the transmitting format of the image data is YUV, the data of the image pixel transmitted at this time comprises three variable Y, U and V which represent the pixel colors. When the three variables of the data of one pixel are Y=0, U=128 and V=128, it represents that the pixel is black. Determining whether all the pixels of the image data satisfy Y=0, U=128 and V=128 one by one is to determine whether all the pixels of the image data are black one by one. When all the pixels included in the image data are black, the image data is considered as all-black image data.

[0019] Situation II: When the transmitting format of the image data is RGB, the data of the image pixel transmitted at this time comprises three variables R, G and B which represent the color variables of the pixels. When the three variables of the data of one pixel are R=0, G=0 and B=0, it represents that the pixel is black. Determining whether all the pixels of the image data satisfy R=0, G=0 and B=0, one by one is to determine whether all the pixels of the image data are black one by one. When all the pixels included in the image data are black, the image data is considered as all-black image data.

[0020] Preferably, in the foregoing two situations, when a certain pixel in the image is determined not to be black, then the image data is directly determined to be not all-black image data without needing to determine whether other pixels of the image are black, which is beneficial for saving memory, and improving the running speed of the system.

[0021] Preferably, a specific implementation process is taken as an example to further interpret the determining of the foregoing all-black image. FIG.2 is a flow chart of determining whether one frame of image data is all-black image data in a method for controlling a mobile phone to be mute through flip according to the present invention. As shown in FIG.2, if one frame of images consists of CMAX pixels, then the step of determining the all-black data specifically comprises the following steps.

[0022] Step 301: The front-facing camera receives one frame synchronization signal and transmits one frame of image data to the mobile phone base band chip. To be specific, the front-facing camera receives one frame synchronization signal and transmits the CMAX pixel data of one frame of images to the mobile phone base band chip.

[0023] Step 302: The base band chip initializes a counter C, wherein an initial value is 1. Then enter step 303.

[0024] Step 303: Compare the current value of the counter C with the number CMAX of the pixels included in the image, and detect whether the current value of the counter C is smaller than or equal to the CMAX; if yes, then enter step 304; otherwise, enter step 307.

[0025] Step 304: Acquire the data of one pixel from the image data of the current frame, and enter step 305.

[0026] Step 305: Determine whether the currently acquired pixel data is black by using a specific determining method as described above. If the current pixel is black, then enter step 306; otherwise, enter step 308.

[0027] Step 306: Add 1 for the counter C, return to step 303 and continuously determine whether other pixel data is black.

[0028] Step 307: When all the pixels included in the image data are black, determine the image data as all-black image data. Finish the process of determining the all-black image data.

[0029] Step 308: When a certain pixel in the image is found not to be black, directly determine that the image data is not all-black image data without needing to determine whether other pixels of the image are black. Finish the process of determining the all-black image data.

[0030] Further, a specific implementation process is taken as an example to further interpret the method for controlling a mobile phone to be mute through flip according to the present invention. FIG.3 is a flow chart of specially applying and implementing the method for controlling a mobile phone to be mute through flip according to the present invention. As shown in FIG.3, the method comprises the following steps.

[0031] Step 001: The mobile phone receives a call, and enter step 21.

[0032] Step 21: The mobile phone monitors whether the situational pattern thereof is not a mute pattern; if the situational pattern is a mute pattern, directly skip to step 002. Otherwise, enter step 22.

[0033] Step 22: The front-facing camera captures a frame of images in every preset time, and transmits the frame of images captured to the mobile phone base band chip.

[0034] Step 23: The mobile phone base band chip determines whether the image data is all-black image data; if yes, enter step 24; otherwise, return to step 22.

[0035] Step 24: Check whether last frame of images is all-black image data; if yes, then enter step 25; otherwise, return to step 22.

[0036] Step 25: Control the mobile phone to switch the situational pattern of the mobile phone into the mute pattern, and enter step 002.

[0037] Step 002: Control the front-facing camera of the mobile phone to stop continuously capturing images, and the mobile phone finishes mute control through flip.

[0038] Meanwhile, the mobile phone base band chip further monitors whether a hang-up signal exists in real time. Therefore, in the embodiment, after the process of mute control through flip of the mobile phone when receiving a call, namely after the step 001, the following steps are entered at the same time.

[0039] Step 001: The mobile phone receives a call, and enter step 31 at the same time.

[0040] Step 31: The mobile phone base band chip monitors a hang-up signal in real time.

[0041] Step 32: Is the hang-up of the other side monitored? If yes, enter step 33; otherwise, return to step 31 and continuously monitor a hang-up signal.

[0042] Step 33: When monitoring the hang-up of the other side, the mobile phone stops ringing; then immediately enter step 002.

[0043] Step 002: The front-facing camera stops capturing images.

[0044] Because steps 31~33 are performed asynchronously from steps 21 ~ 25, no matter which one of steps 21, 22, 23, 24 and 25 is performed, the performing of steps 31~33 is not influenced. Moreover, as long as the determination result of step 32 is true; to be specific, once the hang-up of the incoming call is monitored, immediately perform step 33 and enter step 002. The function of being mute through flip is also closed, which namely terminates performing steps 21~25 immediately.

[0045] Based on the foregoing embodiments, the embodiments of the present invention further provide a mobile phone to be mute through flip. As shown in FIG.4, the mobile phone comprises a front-facing camera 510, a base band chip 520 and a ring output module 530, wherein the base band chip 520 further comprises an image acquisition module 521, an all-black judgment module 522, a flip judgment module 523, a ring control module 524 and a hang-up detection module 525.

[0046] The front-facing camera 510 is set on the main operation interface of the mobile phone, which is used for acquiring image data every preset time when the mobile phone receives a call and the situational pattern of the mobile phone is in the ringing pattern, and transmitting the image data to the base band chip 520. The preset time may be 100ms, 50ms and the like. The value may be set and saved in a mobile phone system when delivery. The details are as described in the foregoing embodiments and will not be repeatedly described any longer.

[0047] The image acquisition module 521 is used acquiring the image data transmitted by the front-facing camera 510 when the mobile phone receives a call and the situational pattern of the mobile phone is a ringing pattern. The details are as described in the foregoing embodiments.

[0048] The all-black judgment module 522 is used for determining whether the image data received by the image acquisition module 521 is all-black image data and caching storing the determination result. The details are as described in the foregoing embodiments.

[0049] The flip judgment module 523 is used for checking, when the all-black judgment module 522 determines that the currently acquired image data is all-black image data, whether the determination result of the all-black judgment module 522 for the image data acquired in the previous time is not all-black image data; when the image data acquired in the previous time is not all-black image data, then determining a flip action occurs to the mobile phone, and sending a mute control message to the ring control module 524. The details are as described in the foregoing embodiments.

[0050] The hang-up monitoring module 525 is used for monitoring a hang-up signal, and sending a ring termination message to the ring control module 524 when monitoring that the other side hangs up the call. The details are as described in the foregoing embodiments.

[0051] The ring control module 524 is connected with the ring output module 530, and is used for controlling the ring output module 530 to output mute after receiving the mute control message, and used for controlling the ring output module 530 to terminate to output ring after receiving the ring termination message.

[0052] Further, the base band chip 520 is further used for controlling the front-facing camera 510 to stop continuously capturing the image (acquiring the image data) when the flip judgment module 523 determines that a flip action occurs to the mobile phone, or the hang-up monitoring module 525 monitors that the other side hangs up the call. The details are as described in the foregoing embodiments.

[0053] Further, the situation that the front-facing camera 510 is connected with the image acquisition module 521 of the mobile phone base band chip is shown in FIG. 5. A frame synchronization signal line CAMVS of the front-facing camera 510 is connected with a frame synchronization signal line VSYNC of the image acquisition module 521. The data signal lines CAMD0 ~ CAMD7 of the front-facing camera 510 are respectively connected with the data signal lines DATA0 ~ DATA7 of the image acquisition module 521. Through this connecting relationship, when the front-facing camera receives a frame synchronization signal, the specific process of transmitting one frame of image data is as follows: when the frame synchronization signal line CAMVS of the front-facing camera changes from a low level to a high level, the image acquisition module 521 is triggered to start receiving a frame of image data; the CMAX pixels of the frame of image data are outputted one by one through the data signal lines CAMD0 ~ CAMD7 of the front-facing camera, and received by the data signal lines DATA0 ~ DATA7 of the image acquisition module 521; when the frame synchronization signal line CAMVS changes from a high level to a lower level, the image acquisition module 521 is notified that the current frame of image data is completely transmitted, and the data signal lines DATA0 ~ DATA7 of the image acquisition module 521 stop receiving data.

[0054] Preferably, as shown in FIG.6, the all-black judgment module 522 further comprises:

a first pixel judgment unit 201 used for determining whether all pixels of the image data satisfy Y=0, U=128 and V=128 when the transmitting format of the image data is YUV; if yes, then determining that the pixel is black;

a second pixel judgment unit 202 used for determining whether all the pixels of the image data satisfy R=0, G=0 and B=0 when the transmitting format of the image data is RGB; if yes, then determining that the pixel is black;

a first image judgment unit 203 used for determining that the image data is the all-black image data when all the pixels included in the image data are black; and

a second image judgment unit 204 used for determining that the image data is not the all-black image data when detecting that one of the pixels is not black.

[0055] Preferably, as shown in FIG.7, the ring control module 524 further comprises:

a mute control unit 401 used for controlling the ring output module 530 to output mute when receiving the mute control message; and

a ring termination unit 402 used for controlling the ring output module 530 to terminate the ring when the hang-up monitoring module 521 monitors that the other side hangs up the call.

[0056] Further, as illustrated in the embodiment of the present invention, the main operation interface of the mobile phone is a flat plane, and the front camera placed on the plane.

[0057] To sum up, according to the method for controlling a mobile phone to be mute through flip and the mobile phone provided by the present invention, the mobile phone is added with a new function. That is, when the mobile phone receives a call, the mobile phone automatically detects the situational pattern. When the situational pattern is not a mute pattern, the image data is acquired in real time through the front-facing camera of the mobile phone, and the acquired image data is transmitted to the mobile phone base band chip. When determining that the acquired image data is all-black image data and the image data acquired in the previous time is not all-black image data, a flip action is considered to occur to the mobile phone, and the mobile phone automatically switches the situational pattern into the mute pattern. Through the technical solution of the present invention, the user can conveniently and quickly switch the situational pattern of the mobile phone into the mute pattern only through a simple flip action of the mobile phone and can make the phone mute without needing to reject the incoming call in some specific occasions which are not suitable for playing the incoming ring or vibra alert such as during a meeting, a class and the like. The mobile phone is particularly suitable for a situation when the mobile phone is under a moving state or located on an inclined plane. Moreover, the mobile phone has a simple structure and high control accuracy, and provides convenience for the user.

[0058] A person having ordinary skill in the art may understand that all or partial flows for implementing the methods according to the foregoing embodiments are programs that may be finished by relational hardware instructed by a computer program, and may be stored in a readable storage medium. The program while in performing may comprise the flows of each method according to the foregoing embodiments. The storage medium may be a disk, an optical disk, a read-only memory (ROM) or a random access memory (RAM), and the like.

[0059] It should be understood that applications of the present invention are not limited to the foregoing examples. A person having ordinary skill in the art may improve or transform the present invention according to the foregoing descriptions, for example, the prevention may be applied to other mobile terminals. All improvements and transformations shall fall within the protection scope of the claims of the present invention.

Claims

1. A method for controlling a mobile phone to be mute through flip, comprising the following steps of:

   - when a mobile phone receives a call, detecting a situational pattern of the mobile phone;
   - if the situational pattern is in a ringing pattern, controlling a front-facing camera placed on a plane where the main operation interface of the mobile phone is located to acquire image data every preset time;
   - transmitting the image data to a mobile phone base band chip; and
   - using the mobile phone base band chip to determine whether the image data is all-black image data and caching storing the determination result; if the current image data is all-black and image data acquired in previous time is not all-black image data, switching the situational pattern of the mobile phone into a mute pattern, and controlling the front-facing camera to stop acquiring image data.

2. The method for controlling a mobile phone to be mute through flip according to claim 1, further comprising the step of:

   - when monitoring phone hang-up, controlling the mobile phone to stop ringing, and controlling the front-facing camera to stop acquiring the image data.

3. The method for controlling a mobile phone to be mute through flip according to claim 1, wherein the step of transmitting the image data to the mobile phone base band chip comprises:

   - using a frame synchronization signal of the front-facing camera to trigger the front-facing camera to transmit the image data to the mobile phone base band chip.

4. The method for controlling a mobile phone to be mute through flip according to claim 3, wherein one frame synchronization signal triggers the front-facing camera to transmit one frame of the image data.

5. The method for controlling a mobile phone to be mute through flip according to claim 1, wherein the step of determining whether the image data is all-black image data comprises:

   - determining whether each pixel in the image data is black; and when detecting that one of the

pixels is not black, determining that the image data is not all-black image data.

6. The method for controlling a mobile phone to be mute through flip according to claim 5, wherein the step of determining whether the image data is all-black image data comprises:

- if the transmitting format of the image data is YUV, then determining whether all the pixels of the image data satisfy Y=0, U=128 and V=128 one by one; if yes, then determining that the pixel is black;
- if the transmitting format of the image data is RGB, then determining whether all the pixels of the image data satisfy R=0, G=0 and B=0 one by one; if yes, then determining that the pixel is black; and
- when all the pixels included in the image data are black, then determining that the image data is the all-black image data.

7. A method for controlling a mobile phone to be mute through flip, comprising the following steps of:

- when a mobile phone receives a call, detecting a situational pattern of the mobile phone; if the situational pattern is a ringing pattern, controlling a front-facing camera placed on a plane where the main operation interface of the mobile phone is located to acquire image data every preset time; and
- determining whether the image data is all-black image data and caching storing the determination result; if the current image data is all-black and image data acquired in previous time is not all-black image data, switching the situational pattern of the mobile phone into a mute pattern, and controlling the front-facing camera to stop acquiring image data.

8. The method for controlling a mobile phone to be mute through flip according to claim 7, further comprising the step of:

- when monitoring phone hang-up, controlling the mobile phone to stop ringing, and controlling the front-facing camera to stop acquiring the image data.

9. The method for controlling a mobile phone to be mute through flip according to claim 7, wherein the method after the step of when a mobile phone receives a call, detecting a situational pattern of the mobile phone; if the situational pattern is a ringing pattern, controlling a front-facing camera placed on a plane where the main operation interface of the mobile phone is located to acquire image data every preset time, and before the step of determining whether the image data is all-black image data and caching storing the determination result; if the current image data is all-black and image data acquired in previous time is not all-black image data, switching the situational pattern of the mobile phone into a mute pattern, and controlling the front-facing camera to stop acquiring image data. The method further comprises the step of:

- using a frame synchronization signal of the front-facing camera to trigger the front-facing camera to transmit the image data to the mobile phone base band chip.

10. The method for controlling a mobile phone to be mute through flip according to claim 9, wherein one frame synchronization signal triggers the front-facing camera to transmit one frame of the image data.

11. The method for controlling a mobile phone to be mute through flip according to claim 7, wherein the step of determining whether the image data is all-black image data comprises:

- determining whether each pixel in the image data is black; and when detecting that one of the pixels is not black, determining that the image data is not all-black image data.

12. The method for controlling a mobile phone to be mute through flip according to claim 11, wherein the step of determining whether the image data is all-black image data comprises:

- if the transmitting format of the image data is YUV, then determining whether all the pixels of the image data satisfy Y=0, U=128 and V=128; if yes, then determining that the pixel is black;
- if the transmitting format of the image data is RGB, then determining whether all the pixels of the image data satisfy R=0, G=0 and B=0; if yes, then determining that the pixel is black; and
- when all the pixels included in the image data are black, then determining that the image data is the all-black image data.

13. A mobile phone to be mute through flip, comprising:

- a base band chip which comprises an image acquisition module, an all-black judgment module, a flip judgment module and a ring control module;
- a front-facing camera placed on the main operation interface of the mobile phone, used for acquiring image data every preset time when the mobile phone receives a call and the situational pattern of the mobile phone is a ringing

pattern, and transmitting the image data to the image acquisition module; and
- a ring output module,
- wherein the image acquisition module is used for acquiring the image data transmitted by the front-facing camera when
- the mobile phone receives a call, and the situational pattern of the mobile phone is a ringing pattern;
- the all-black judgment module is used for determining whether the image data acquired by the image acquisition module is all-black image data and caching storing the determination result;
- the flip judgment module is used for sending a mute control message to the ring control module when the all-black judgment module determines that the current image data is all-black image data and the image data acquired in the previous time is not all-black image data, and triggering the base band chip to control the front-facing camera to stop acquiring the image data at the same time; and
- the ring control module is used for controlling the ring output module to output different modes of rings.

14. The mobile phone to be mute through flip according to claim 13, wherein the base band chip further comprises:

- a hang-up monitoring module, used for sending a ring termination message to the ring control module when monitoring a phone hang-up, and also triggering the base band chip to control the front-facing camera to stop acquiring the image data at the same time.

15. The mobile phone to be mute through flip according to claim 13, wherein a frame synchronization signal of the front-facing camera is used to trigger the front-facing camera to transmit the image data to the image acquisition module.

16. The mobile phone to be mute through flip according to claim 15, wherein one frame synchronization signal triggers the front-facing camera to transmit one frame of the image data.

17. The mobile phone to be mute through flip according to claim 13, wherein the all-black judgment module is used for determining whether each pixel in the image data is black; and when detecting that one of the pixels is not black, determining that the image data is not all-black image data.

18. The mobile phone to be mute through flip according to claim 17, wherein the all-black judgment module comprises:

- a first pixel judgment unit, used for determining whether all pixels of the image data satisfy Y=0, U=128 and V=128 when the transmitting format of the image data is YUV; if yes, then determining that the pixel is black;
- a second pixel judgment unit, used for determining whether all the pixels of the image data satisfy R=0, G=0 and B=0 when the transmitting format of the image data is RGB; if yes, then determining that the pixel is black; and
- a first image judgment unit, used for determining that the image data is the all-black image data when all the pixels included in the image data are black; and
- a second image judgment unit, used for determining that the image data is not the all-black image data when one of the pixels is not black.

19. The mobile phone according to claim 14, wherein the ring control module comprises:

- a mute control unit, used for controlling the ring output module to output mute when receiving the mute control message; and
- a ring termination unit, used for controlling the ring output module to terminate the ring when receiving the ring termination message.

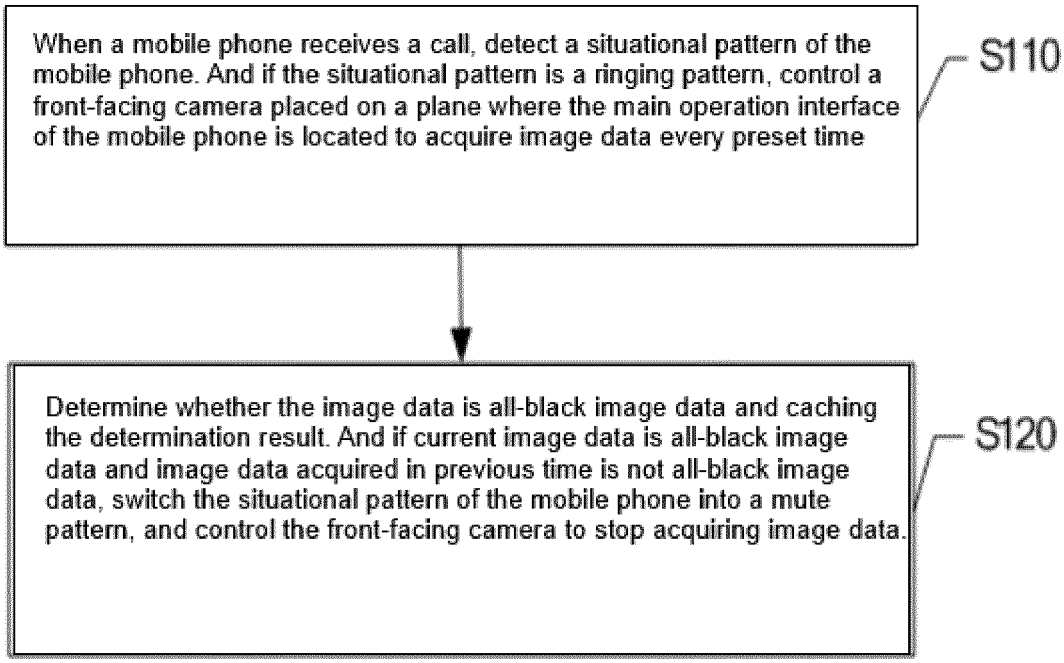
When a mobile phone receives a call, detect a situational pattern of the mobile phone. And if the situational pattern is a ringing pattern, control a front-facing camera placed on a plane where the main operation interface of the mobile phone is located to acquire image data every preset time
S110
Determine whether the image data is all-black image data and caching the determination result. And if current image data is all-black image data and image data acquired in previous time is not all-black image data, switch the situational pattern of the mobile phone into a mute pattern, and control the front-facing camera to stop acquiring image data.
S120

FIG. 1

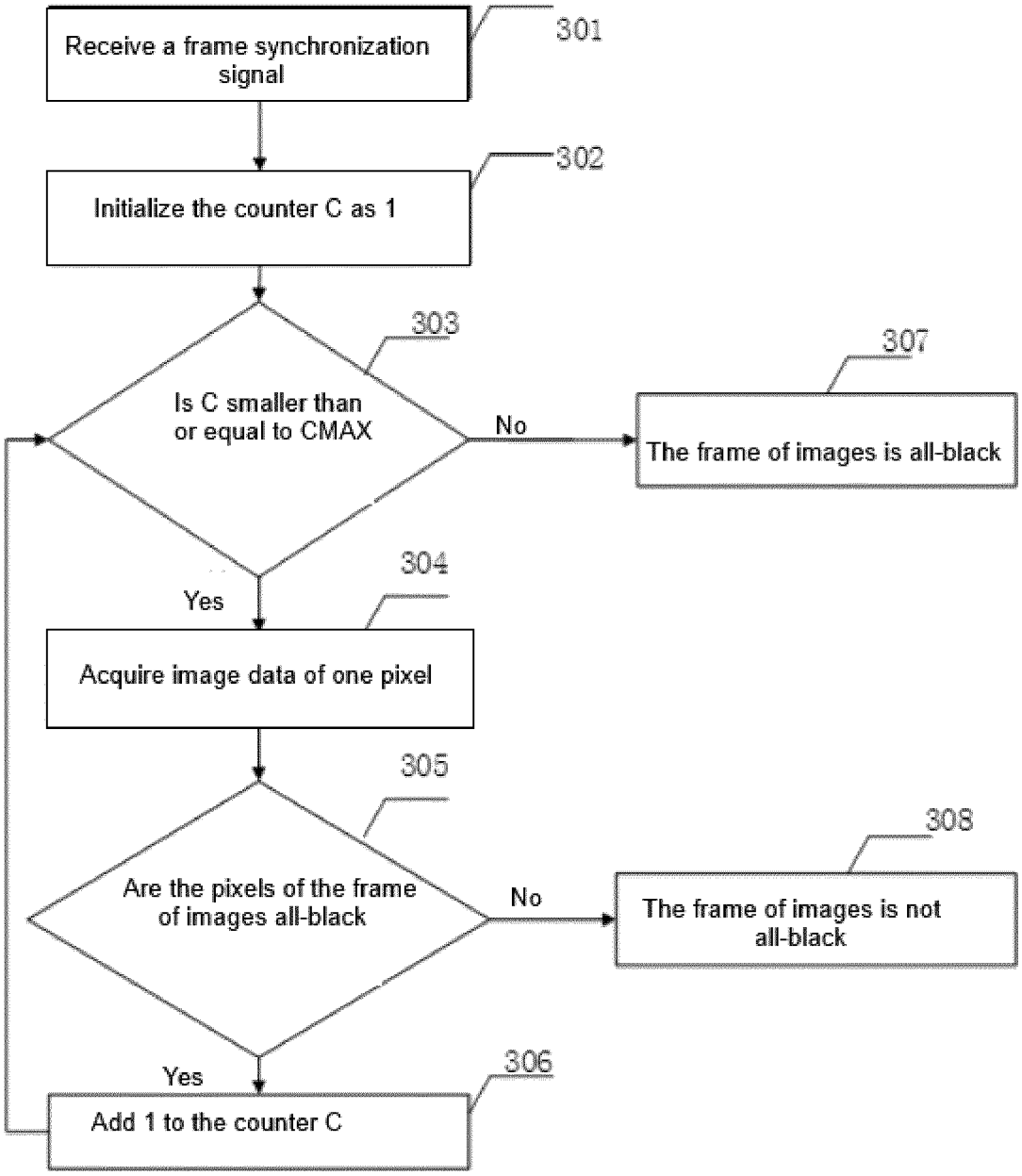
Receive a frame synchronization signal
301
Initialize the counter C as 1
302
Is C smaller than or equal to CMAX
303
No
307
The frame of images is all-black
Yes
304
Acquire image data of one pixel
305
Are the pixels of the frame of images all-black
308
No
The frame of images is not all-black
Yes
306
Add 1 to the counter C

FIG. 2

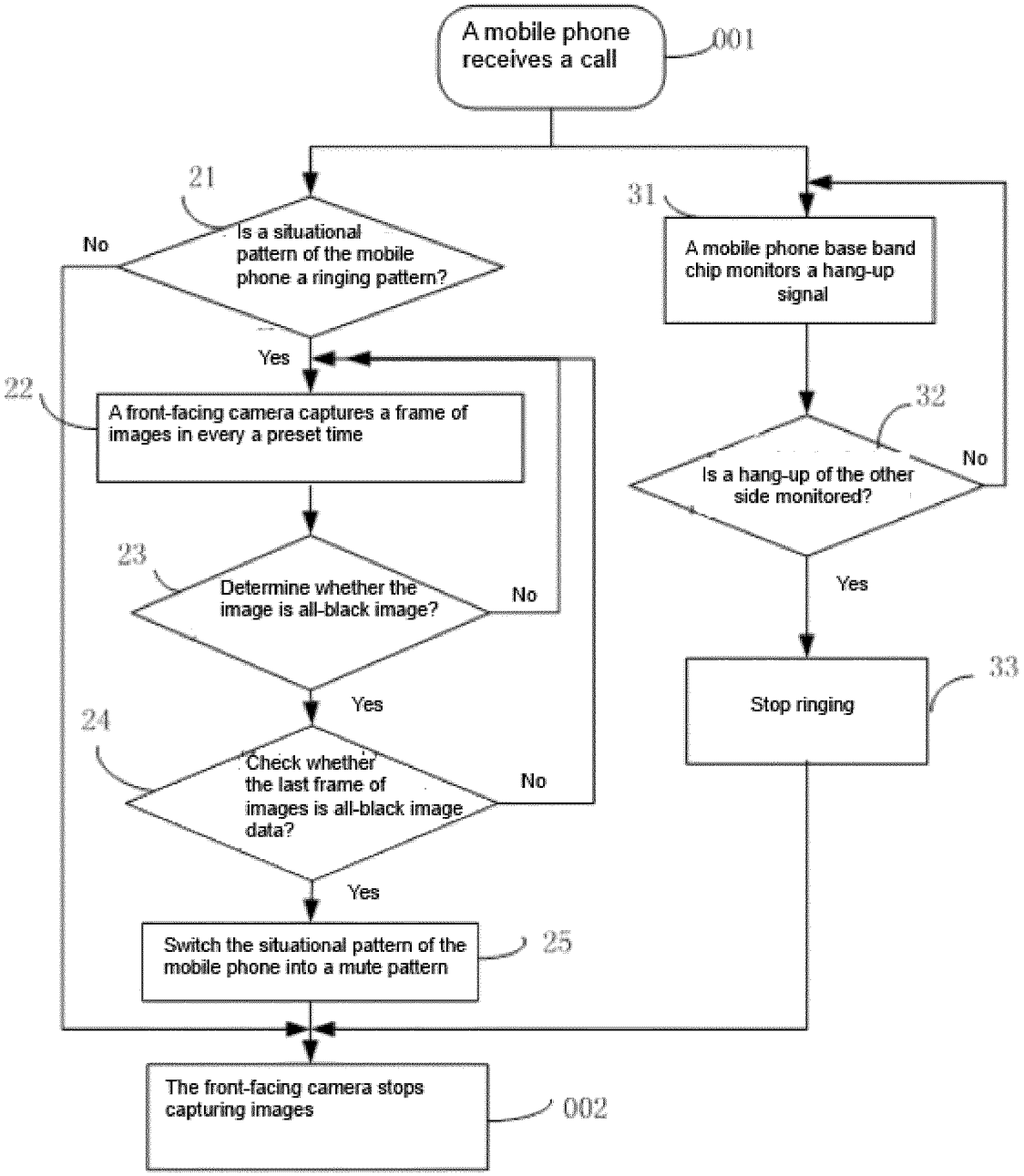
A mobile phone receives a call
001
21
Is a situational pattern of the mobile phone a ringing pattern?
No
Yes
22
A front-facing camera captures a frame of images in every a preset time
23
Determine whether the image is all-black image?
No
Yes
24
Check whether the last frame of images is all-black image data?
No
Yes
Switch the situational pattern of the mobile phone into a mute pattern
25
31
A mobile phone base band chip monitors a hang-up signal
32
Is a hang-up of the other side monitored?
No
Yes
Stop ringing
33
The front-facing camera stops capturing images
002

FIG. 3

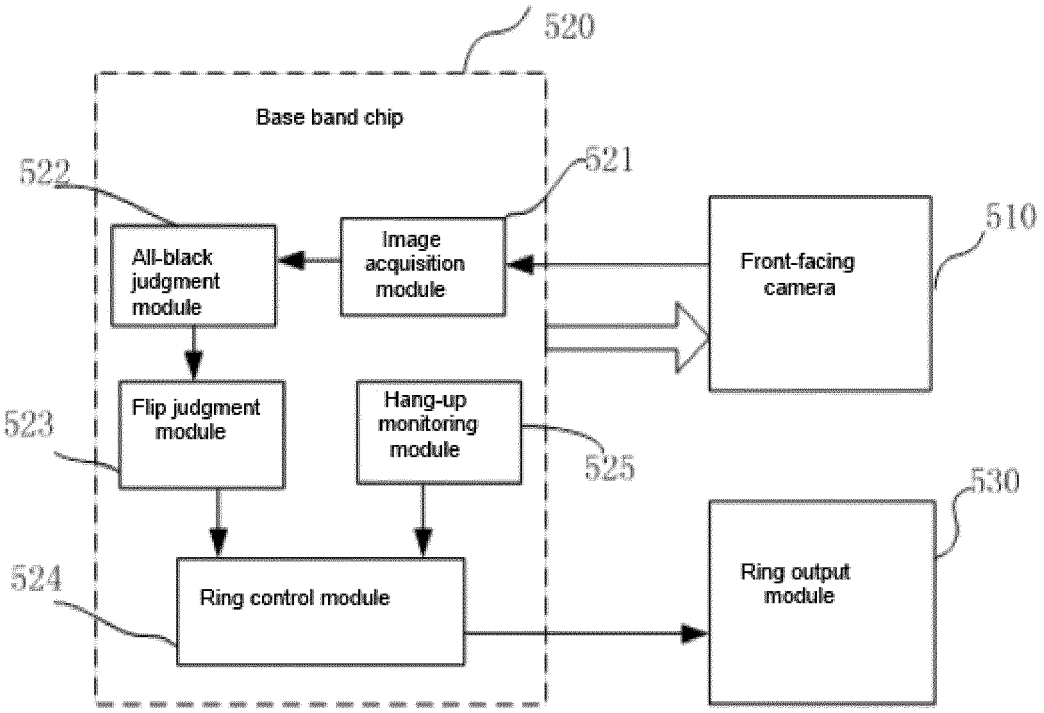
520
Base band chip
522
521
All-black judgment module
Image acquisition module
Front-facing camera
510
Flip judgment module
Hang-up monitoring module
523
525
530
524
Ring control module
Ring output module

FIG. 4

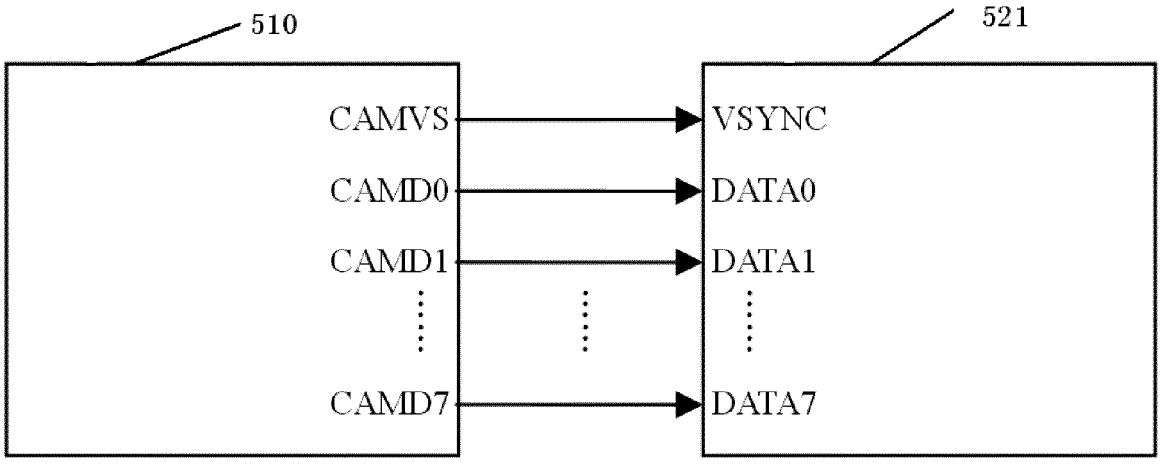
510
521
CAMVS
CAMD0
CAMD1
CAMD7
VSYNC
DATA0
DATA1
DATA7

FIG. 5

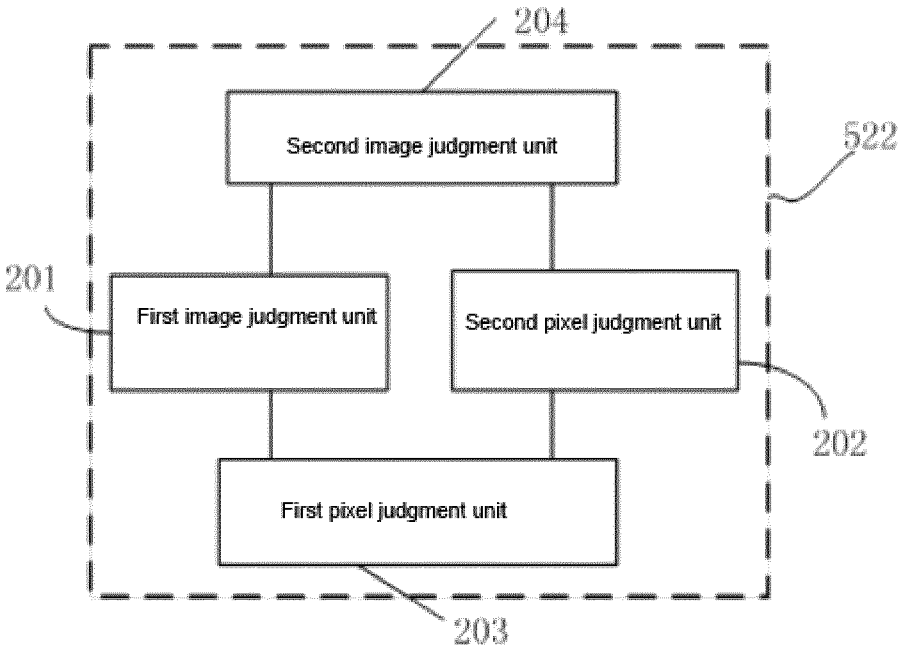
204
Second image judgment unit
522
201
First image judgment unit
Second pixel judgment unit
202
First pixel judgment unit
203

FIG. 6

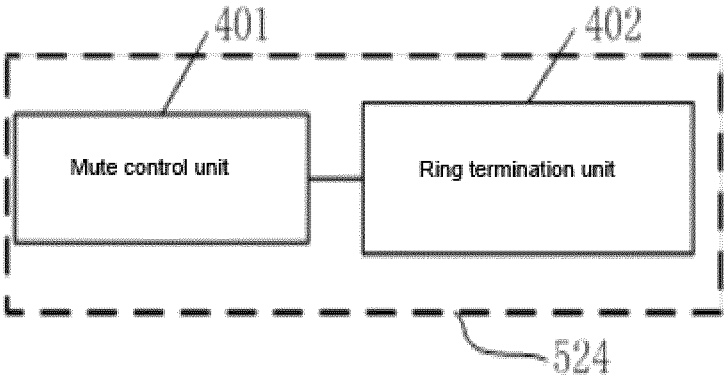
401
402
Mute control unit
Ring termination unit
524

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/078466

A. CLASSIFICATION OF SUBJECT MATTER

H04M 1/725 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G06F; H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, CNKI, WPI, EPODOC, IEEE: mobile phone, mute, overturn, mode, switch, camera, image, black

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102647509 A (GUANGDONG BUBUGAO ELECTRONIC INDUSTRY CO., LTD.) 22 August 2012 (22.08.2012) description, pages 2 and 3	1-19
PX	CN 102833416 A (HUIZHOU TCL MOBILE COMMUNICATION CO., LTD.) 19 December 2012 (19.12.2012) description, pages 1-3	1-19
A	CN 102638598 A (HUAWEI DEVICE CO., LTD.) 15 August 2012 (15.08.2012) the whole document	1-19

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 September 2013 (02.09.2013)	17 October 2013 (17.10.2013)

Name and mailing address of the ISA	Authorized officer
State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	XIE, Xin Telephone No. (86-10) 62413670

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/078466

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 102647509 A	22.08.2012	None	
CN 102833416 A	19.12.2012	None	
CN 102638598 A	15.08.2012	None	